

Specifications for Dual Collector Depressor Unit

The Naval Research Laboratory (NRL) has a requirement for a dual collector depressor unit for integration with an existing Electromatic Inc. (ETM) Model 2062PD.2 modulator/power supply. The unit must be compatible with the collector depressor units (2 each) in the existing ETM 2062PD.2 modulator, each of which consist of metering circuitry, a pass-tube, pass-tube power supply, and a regulation amplifier.

As delivered, the dual collector depressor unit must interface with the existing ETM 2062PD.2 electrical, control, metering/monitoring, and safety interlock systems using, as appropriate, wire interconnects to high voltage terminals, two-wire or fiber optic control/interlock cables, and/or interface to the ETM modulator computer control system via the unit's IEEE-488 bus. The interface of the dual depressor unit must be accomplished with little or no modification to the existing ETM 2062PD.2 system.

The dual collector depressor unit must meet or exceed the following minimum specifications:

1. Pre-Loading Requirement: The dual depressor unit must interface with the ETM 2062PD.2 "pre-load" mode to enable the voltages on the collector depressors to be pre-set prior to applying high voltage to the output of the modulator.
2. Depressor Requirements:
 - a. Number of depressor units: 2 each.
 - b. Depressor voltage range: Continuously variable from 2,000 to 20,000 volts, negative with respect to ground (per each depressor unit).
 - c. Average current handling: Maximum of 500 milliamperes of average collector current over the full operating voltage range (per each depressor unit) with up to 1 ampere average collector current subject to power dissipation limitations on the collector regulators (per each depressor unit).
 - d. Peak current handling: Up to 2 amperes peak current over the full operating voltage range (per each depressor unit).
 - e. Voltage regulation: Under CW operating conditions, the power supply output voltage must not vary by more than 200 volts for a +/- 10% variation in line

voltage and when switching from pre-load to full-load conditions.

f. Voltage ripple:

Under CW operating conditions and full-load conditions, the output voltage ripples must be less than +/- 10 volts peak-to-peak.

g. Transient recovery:

Under pulsed operating conditions with the peak current varying from 0 to 2 amperes, the power supply output voltage must have a maximum transient voltage of +/- 300 volts.

h. Non-depressed operation:

Each collector depressor must be capable of being individually shunted for non-depressed operation.

i. Packaging:

Stand-alone rack with wheels.

3. Electrical Requirements:

a. Input power:

3-phase, 480 VAC

b. Electrical safety:

For personnel protection, the unit must have labeling and high voltage safety interlocks consistent with standard commercial practice.

A large, clearly marked EMERGENCY OFF button shall be provided in a prominent location. Pressing this button will result in the removal of all power in the unit in a controlled fashion consistent with personnel and equipment safety.

c. Output connections:

Positive and negative common collector return terminals shall be placed in an insulated, interlocked, accessible panel with a location to be determined in consultation with NRL. The output jacks shall accept banana jacks or ring lug connections. All connections must be clearly labeled.

4. Cooling:

Forced air-cooled and/or industrial chilled water. Inlet and outlet fittings shall be Hansen disconnects or the equivalent and shall be easily accessible.

5. Monitoring:

a. Voltage monitoring: Allow collector voltages (up to full-scale) to be monitored with respect to cathode or with respect to ground (user-selectable).

In addition, provide cathode voltage metering from dual depressor unit.

b. Current monitoring: Allow average and peak currents to be monitored.

c. User-defined fault trips: The following fault trips must be capable of being set by the user (actions appropriate to personnel safety and equipment safety will occur as a result of a detected fault):

Collector over-voltage (per each depressor unit)

Collector under-voltage (per each depressor unit)

Collector over-current (per each depressor unit)

d. External interlocks: A minimum of three external interlock connectors must be provided to be used to communicate with external equipment as to possible fault conditions in the dual depressor unit.

For compatibility with the ETM 2062PD.2 system, these interlocks shall use an MS3102A-14S-6S connector mounted on the front or side panel with the interlock across pins A and B. During normal operation, contact between pins A and B will be closed; in event of a fault, the contacts will be open. The dual depressor unit will accept a +24 volt reset signal applied at pin C with the return on pin E.

e. System fault detection: In addition to faults defined by 5(c) and 5(d), fault detection must include, but is not limited

to, the following (actions appropriate to personnel safety and equipment safety will occur as a result of a detected fault):

Cooling fault (air and/or liquid flow fault)
High voltage panel (internal/external) open fault

6. Status/Control Interlocks and Interface to ETM 2062PD.2:

The dual depressor unit must interface with existing ETM 2062PD.2 interlock, status, and control chains. In addition to its own internal control chain and interlocks, the dual depressor unit must also communicate with the ETM 2062PD.2 control and interlock system and operate as an integral part of the complete system control and interlock chain with little or no modification of existing ETM 2062PD.2 hardware.

The dual depressor unit must provide but is not limited to the following Status/Control interlocks:

- a. COLLECTOR READY OUT integrated into the cathode high voltage interlock chain.
- b. HIGH VOLTAGE READY IN to acknowledge completion of the cathode high voltage interlock chain.
- c. PULSE READY to indicate ready status of dual depressor high voltage, cathode high voltage, crowbar in un-fired state, and collector faults cleared.
- d. REMOTE TURN-ON button or key-switch to enable user selection between REMOTE or LOCAL operation. Selection of REMOTE operation will disable LOCAL operation and vice versa. REMOTE operation must conform to the same control and interlock requirements as LOCAL operation.
- e. CROWBAR FIRE OUTPUT provided as a ready signal to the cathode high voltage supply crowbar circuit in the ETM 2062PD.2. For isolation, this signal must be provided via fiber optic cable and, upon detection of a fault, will trigger the cathode supply crowbar.
- f. EXTERNAL INTERLOCKS as specified under Section 5.d above.
- g. AC OUTLET PLUG (120 VAC) that is energized when high voltage is present on the collectors. This plug will optionally power an external warning light (user-supplied) for high voltage safety.

7. The contractor shall offer the Government at least the same warranty terms, including offers of extended warranties, offered to the general public in customary commercial practice. These warranty terms must be included in the system price. The period of the warranty shall begin upon acceptance.
8. A full set of all written documentation customarily provided to the public with a commercial item shall be provided. This shall include users manual(s) or equivalent as well as copies of any software, and any manuals for the software included with the system, if customarily provided. In addition, documentation shall include explanations of each major block of the operational circuit, calibration instructions for all metering sub-systems, a full electronics parts list, custom transformer specifications, and schematic and wiring diagrams. This documentation must be received at NRL with the system hardware, unless other arrangements are agreed to by the NRL representative.